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(71) Applicant *(for all designated States except US)*: BP AMOCO CORPORATION [US/US]; Law Dept., Mail Code 1907A, 200 E. Randolph Drive, P.O. Box 87703, Chicago, IL 60680-0703 (US).

(72) Inventors; and
(75) Inventors/Applicants *(for US only)*: WINIECKI, Gerald, R. [US/US]; 9510 Holt Park Road, Suring, WI 54174 (US). ANTONACCI, Paul, N. [US/US]; 3061 Vinings Ridge Drive, Atlanta, GA 30339 (US). RUSERT, Craig, R. [US/US]; 1005 Redstone Lane, Dunwoody, GA 30338 (US).

(74) Agent: HENSLEY, Stephen, L.; BP Amoco Corporation, Law Dept., Mail Code 1907A, P.O. Box 87703, Chicago, IL 60680-0703 (US).

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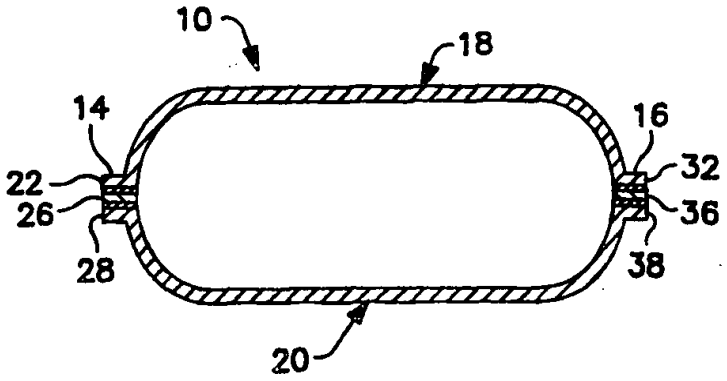
(54) Title: METHOD AND APPARATUS FOR PRODUCTION OF BAGS

(57) Abstract

The present invention provides an improved method and apparatus for production of open mesh bags. The method and apparatus produces heat-sealable seam bag stock for making individual bags having a closed end formed by folding the fabric, an open end capable of being sealed and longitudinal, improved strength heat-sealed side seams containing strips of heat-sealable material extending from the closed end to the open end. The process for making open mesh bags comprises the steps of applying to an open mesh substrate (18, 20) a print band material bearing a readable indicator and applying to the substrate at selected positions strips (26, 36) of a thermoplastic resin to which the substrate is heat sealable, wherein the positions of the strips are selected based on the indicators on the print band material.



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METHOD AND APPARATUS FOR PRODUCTION OF BAGS

This application claims the benefit of U. S. Application No. 60/085,478 filed May 14, 1998.

Field Of The Invention

This invention relates to a method and apparatus for producing bags, and especially open mesh bags, with heat-sealed seams and bag stock with heat sealable strips for seaming.

Background Of The Invention

Produce bags have, in general, been made from solid plastic films, extruded netting, tubular leno weave materials, or flat woven materials. Open mesh materials, such as woven and knitted fabrics, extruded netting and netlike nonwovens, are well suited as substrates for produce and other bags because they have traditional attributes of produce bags, including strength, breathability and sufficient transparency or openness to allow viewing of their contents. Further, as discussed in U. S. 5,822,683, open mesh substrates also having suitable dimensional stability and frictional properties are suited for use with high speed and automated bagmaking and filling equipment. However, a difficulty in making bags from such open mesh substrates is that the substrates are difficult to seam. Sewing is costly and inefficient, while heat-sealing of seams is often ineffective because the open, often delicate netlike structure of the substrates presents little surface area for contact and sealing to form seams. Bags constructed by heat-sealing a panel of open mesh substrate to a panel of solid thermoplastic film at their edges to form seams have been proposed to provide stronger seams but the resulting bags suffer from poor aesthetics, and manufacturing cost and complexity due to the use of different substrate materials and unavailability of folding for forming one closed edge of a bag. Use of strips of thermoplastic films for heat-sealing open mesh substrates at their edges is complicated by the need for separate application and sealing of the strips and by

difficulties in precise cutting and positioning of the strips on the substrate in high speed operations.

U. S. 3,939,628 to Schjeldahl discloses a method and an apparatus for forming in-line on a package-making machine a closure for packages made from tubular plastic open-mesh netting by positioning two strips of material having adhesive coatings one on either side of the tubular netting and adhering the strips together through the open-mesh netting to form a closure on the bag. Other patents and publications disclosing methods and equipment for making bags are U. S. 3,257,915; U. S. 4,207,983; and German Patent No. 2,636,821. However, there remains a need for improved bagmaking equipment and processes.

Summary Of The Invention

Briefly, this invention provides a method and apparatus for the production of heat-sealable seam bag stock and heat-sealed seam bags.

In one embodiment, this invention provides a process for making open mesh bags comprising the steps of applying to an open mesh substrate a print band material bearing a readable indicator and applying to the substrate at selected positions strips of a thermoplastic resin to which the substrate is heat sealable, wherein the positions of the strips are selected based on the indicators on the print band material.

In another embodiment, the invention provides a process for making open mesh bags comprising the steps of applying to an open mesh substrate at selected positions strips of a thermoplastic resin to which the substrate is heat sealable, folding the substrate along a central axis, wherein the axis and the strips are perpendicularly or essentially perpendicularly disposed, and heat sealing the substrate from both sides of the fold to the strips. The process also can comprise additional steps such as applying a label to the substrate, cutting the substrate, before or after folding or heat sealing, into individual bags or appropriate sizes for individual bags, wicketing and stacking.

In another embodiment, manufacture of bag stock comprising open mesh substrate with strips of heat sealable film comprising a thermoplastic resin affixed thereto, and most preferably heat sealed to the substrate along an edge of the film, is conducted in a first operation and the stock is converted into individual bags in a subsequent operation. Preferably, the bag stock is prepared in the form of roll goods to facilitate collection and handling of the bag stock and feeding the same to the ultimate bagmaking step. In another embodiment, the bag stock is conveyed directly to the bagmaking operation comprising folding the bag stock and heat sealing of side seams.

The invention also provides an apparatus and method for the manufacture of heat-sealable seam bag stock from open mesh fabric comprising advancing a continuous, heat sealable open mesh fabric in a longitudinal direction, providing one or more print bands to a first side of the open mesh fabric, heat sealing the print bands to the open mesh fabric, intermittently stopping and restarting advancement of the open mesh fabric in the longitudinal direction, attaching to the open mesh fabric in a cross direction at preselected intervals and during the intermittent stops in advancement of the fabric predetermined lengths of a polymeric film to produce a heat-sealable seam bag stock, and winding the heat-sealable seam bag stock onto a roll. The invention also provides an apparatus and method for the manufacture of open mesh bags in the form of heat-sealed side seam bag stock or individual bags comprising providing continuously in a longitudinal direction a heat-sealable seam bag stock, folding the bag stock such that it has a fold in the longitudinal direction with two overlapping layers of bag stock of predetermined lengths extending from the fold with the heat sealable polymeric film strip located on inner sides of the folded bag stock and the one or more print bands located on at least one outer side of the folded bag stock, stopping advancement of the bag stock intermittently in registration with an intermediate station while maintaining continuous supply of the bag stock and continuous removal of bags, heat sealing the layers of th bag stock togeth r

with the film strip at the intermediate station and in a cross direction to form a heat-sealed side seam bag, and collecting the heat-sealed side seam bags.

A preferred apparatus for manufacture of bag stock comprises, in combination, means for advancing each of a bag substrate, thermoplastic polymeric film and print band from sources thereof continuously through the apparatus such that the film is brought into contact with one side of the substrate and the print band is brought into contact with the same or an opposing side of the substrate; means for intermittently stopping and resuming passage of the substrate, film and print band through the apparatus based on indicators detectable from the print band; a strip applicator disposed in the path of the substrate and the film comprising means for transversely affixing a leading edge of the film to the substrate and means for transversely cutting the film at a selected distance upstream of the leading edge thereof; a heat sealing device located in the path of the substrate and the print band downstream of the point at which the substrate contacts the print band for longitudinally heat sealing the print band to the substrate; and takeoff means. In a still further embodiment, such an apparatus further comprises means disposed after the strip applicator and the heat seal device, but before the takeoff means, for folding the substrate with affixed polymeric strips to form a fold extending in the direction of advancement of the substrate, means for heat sealing the substrate and the film to form a seam, and, optionally, means for cutting the seamed substrate at the seam.

Brief Description of the Drawings

Described hereinafter in detail are certain nonlimiting embodiments of the invention with reference to the accompanying drawings in which:

Fig. 1 is a perspective view of an open mesh bag produced by the method and apparatus according to the invention.

Fig. 2 is a cross-sectional view of the open mesh bag of Fig. 1.

Fig. 3 is a perspective view of a roll of heat-sealable seam bag stock produced by the apparatus of Fig. 4.

Fig. 4 is a schematic view of an apparatus according to the invention for producing heat-sealable seam bag stock.

Fig. 5 is a side view of the print band system of Fig. 4.

Fig. 6 is a top view of the print band system of Fig. 4.

Fig. 7 is a schematic view of the sealing strip application system of Fig. 4 in the feed position.

Fig. 8 is a schematic view of the sealing strip application system of Fig. 4 in the cutoff and application to open mesh fabric position.

Fig. 9 is a schematic view of an apparatus according to the invention for converting heat-sealable seam bag stock into various types of open mesh bags.

Detailed Description Of The Invention

In greater detail, In one embodiment, this invention provides a process for making open mesh bags comprising the steps of applying to an open mesh substrate a print band material bearing a readable indicator and applying to the substrate at selected positions strips of a thermoplastic resin to which the substrate is heat sealable, wherein the positions of the strips are selected based on the indicators on the print band material. Preferably, the print band material and the strips of thermoplastic resin are heat sealed to the substrate. Application of the print band material and the film strips can occur in any sequence. Preferably, the print band material and the substrate move in line while indicators on the print band are read by a suitable sensor or reader to determine the positions for application of the film strips and then the print band material is applied to the substrate after application of the strips. However, the print band material maybe applied first if desired. The substrate with applied strips and print band material can be collected, preferably in roll form, and used in separate bagmaking operations. However, the substrate with applied strips and print band mat rial can also be formed into bag stock or bags in line or in

sequence with the strip and print band application steps. A preferred method for making bags in line from the substrate with applied strips and print band material comprises folding the substrate along a central axis such that the axis and the strips are essentially perpendicularly disposed, and heat sealing the substrate from both sides of the fold to the strips to form a seam. The resulting, seamed substrate can be taken up, again preferably in roll form, for use in separate bagmaking steps or operations. Alternatively, the seamed substrate can be cut crosswise at the seam to form bags. In another embodiment, a polymeric film strip is applied to the substrate extending from a side of the fold at or near an end of the substrate opposite the fold. The strip preferably is heat sealed to the substrate. More preferably the film strip extends beyond the end of the substrate. Most preferably, the film strip extending beyond the end of the substrate has holes adapted to receive a wicket.

The present invention also provides a method for production of heat-sealable seam bag stock comprising applying one or more print bands to a bag substrate advancing in a machine direction, intermittently interrupting the advancement of the substrate and attaching thereto at a preselected position and in a cross machine direction a polymeric film strip of predetermined length and comprising a thermoplastic resin that is heat-sealable to the substrate, and taking up a bag stock comprising the substrate having a plurality of attached film strips.

The present invention also provides a method and apparatus for the production of open mesh bags from an open mesh substrate to which has been added polymer film strips by tack sealing one edge of a formed polymer strip to the substrate followed by a light heat-sealing of the strip, most preferably at or near a second edge thereof, to the fabric to maintain the strip in place while the heat-sealable seam bag stock is being processed further. For manufacture of bags the applied heat and pressure, of course, should not be so great as to destroy the integrity of th bag.

One embodiment of the invention includes a method for the manufacture of heat-sealable seam bag stock from open mesh fabric comprising advancing a continuous heat sealable open mesh fabric in a longitudinal direction, providing one or more print bands to a first side of the open mesh fabric, heat sealing the print bands to the open mesh fabric, attaching in registration to the open mesh fabric in a direction transverse to the direction of advancement a predetermined length of a polymeric film that is heat-sealable to the fabric to produce a heat-sealable seam bag stock, advancing the heat-sealable seam bag stock to a next polymeric film attachment position, and winding the heat-sealable seam bag stock onto a roll.

A particular aspect of the method described above for the present invention provides two polymeric print bands to the first side of the open mesh fabric. This is accomplished by providing a double width roll of print band material, preferably from a drum roll with braked unwind shaft, slitting the material from the double width roll of print band material into two print bands, and advancing the two print bands through adjustable position dual turn bars onto the open mesh fabric at equal distances from a longitudinal centerline of the fabric, preferably through adjustable position dual turn bars. Use of double width rolls of print band material provides advantages over single width rolls because application of indicator markings thereto and maintenance of markings on each side of the material in registration during use of the rolls is more uniform than in the case of single width rolls. Use of double width rolls also reduce changeover time. Of course, it also is contemplated to use single width rolls if desired, and to apply a single print band, in which case a single width roll of print band material is utilized or the path of the individual bands formed from a double width roll is modified to effect application of a single band to the substrate.

Another particular aspect is directed to the method for attaching a predetermined length of polymer film or polymer film strip to the substrate. This aspect comprises feeding a predetermined width of a polymeric film capable of

being heat sealed to the substrate from a continuous roll located in the same longitudinal direction as the substrate, positioning the polymer film relative to the substrate such that the leading edge of the polymer film is adjacent to the substrate in a cross machine direction, preferably by providing bursts of air above and below the plane of the polymeric film, stopping the advancement of the substrate in registration at an intermediate station while maintaining a continuous supply of the substrate and removal of a heat-sealed seam bag stock, heat sealing a leading edge of the polymeric film to a second side of the substrate, and cutting the polymeric film at a trailing edge to form a polymeric film strip of predetermined length.

Still another embodiment of the invention provides an apparatus for the manufacture of heat-sealable seam bag stock from open mesh fabric in continuous form comprising in combination and in line:

means for providing and advancing a continuous single layer of a heat sealable open mesh substrate in a longitudinal direction,

means for providing one or more print bands to a first side of the open mesh substrate,

means for heat sealing the print bands to the open mesh substrate,

means for attaching in registration to the open mesh substrate in a cross direction a predetermined length of a polymeric film to produce a heat-sealable seam bag stock,

means for advancing the heat-sealable seam bag stock to a next polymeric film attachment position, and

means for winding the heat-sealable seam bag stock onto a roll.

An improvement of the above described apparatus provides the means for applying two polymeric print bands to the first side of the open mesh substrate comprising a means for providing a double width roll of print band material from a braked unwind shaft, a means for slitting the double width print band material into two print bands, and a means for advancing the two print

bands through adjustable position dual turn bars onto the open mesh substrates at equal distances from the web centerline.

Still another aspect of the above-described apparatus provides the means for attaching a predetermined length of a polymeric film to the open mesh substrate comprising a means for feeding a predetermined length of a polymeric film capable of being heat sealed to the open mesh substrate from a continuous roll located in the same longitudinal direction as the open mesh substrate, a means for providing bursts of air above and below a plane of the polymeric film to assist in positioning the polymer film relative to the open mesh fabric web, a means for stopping the advancement of the open mesh substrate in registration at an intermediate position while maintaining a continuous supply of the open mesh substrate and removal of a heat-sealed seam bag stock, a means for heat sealing a leading edge of the polymeric film to a second side of the open mesh substrate, and a means for cutting the polymeric film at a trailing edge to form a polymeric film strip of predetermined length. Optionally, the apparatus further comprises means for heat sealing the polymeric film strip to the substrate at or near the trailing edge thereof.

Another embodiment of the present invention provides a method and apparatus for the manufacture of open mesh bags from the heat-sealable seam bag stock. The open mesh bags can be in the form of heat-sealed side seam bag stock or a roll of individual bags cut from the roll once the side seams are heat-sealed to create the bags. As described above, the heat-sealable seam bag stock has reinforcing heat-sealable polymer film strips that are lightly heat-sealed or -tacked to the open mesh fabric in a cross-web direction but not heat sealed to the degree that the polymer strip film has lost integrity. In addition, the film strips have not yet been heat sealed in the cross direction to form heat-sealed seams which form the sides of the open mesh bags. In one particular embodiment a method for the manufacture of open mesh bags in the form of heat-sealed sid seam bag stock comprises:

advancing in a longitudinal direction a continuous heat-sealable seam bag stock,

folding the bag stock such that the bag stock has a fold in the longitudinal direction and two overlapping layers of predetermined length from the fold, with the heat sealable polymeric film strip located on the inner sides of the folded bag stock, i.e., between the overlapping layers, and one or more print bands located on the outer sides of the folded bag stock,

intermittently stopping advancement of the bag stock,

heat sealing the layers of the web together in a cross web direction at the location of the polymer film strip to form a heat-sealed side seam bag stock, and

winding the heat-sealed side seam bag stock onto a roll.

Such an embodiment of the invented process is particularly well suited for manufacture of rolls of finished bags, also commonly known as bags-on-roll.

In another embodiment, individual heat-sealed side seam bags with flat tops are produced by a method that comprises advancing in a longitudinal direction a continuous heat-sealable seam bag stock comprising open mesh substrate having a plurality of substantially equally spaced heat sealable polymeric film strips attached thereto, folding the bag stock such that it has a fold in the longitudinal direction to create two overlapping layers of predetermined, equal length from the fold with the heat sealable polymeric film strip located in the interior of the of the overlapping layers and the one or more print bands located on the outer sides of the folded layers, interrupting advancement of the heat-sealable seam bag stock intermittently in registration at an intermediate station, heat sealing the layers and the polymer film strip at the intermediate station to form a heat-sealed side seam bag stock, cutting the heat-sealed side seams at a next station to produce individual heat-sealed side seam bags with flat tops, and collecting the individual heat-sealed side seam bags.

In yet another embodiment, either or both of a wicketed top and vacuum op ning feature is includ d in the heat-sealed side seam bag. In this

embodiment, strips of heat-sealable polymeric film are sealed to the substrate at one or both of the ends thereof that form the top of the bag. For the wicketed top feature, the longitudinal fold in the substrate most preferably is positioned to one side of the longitudinal centerline of the substrate such that longer and shorter sections of the substrate extend from each side of the fold. A heat-sealable polymer film strip, preferably supplied from a roll, is heat-sealed to the longer section of the substrate extending from the fold at the end thereof opposite the fold, which corresponds to the top of the ultimate bag. The film strip most preferably is attached so that it extends past the end of the substrate corresponding to the top of the bag. Holes adapted to receive a wicket are imparted to the strip, most preferably in the portion thereof extending beyond the end of the substrate, and the strip thereby forms a portion of the eventual bag that can be wicketed as easily and effectively as traditional plastic bags made entirely from plastic film. A similar strip can be affixed to the substrate at an end thereof opposite the fold but extending no further than the end of the substrate opposite the fold, and preferably terminating slightly below the end of the substrate, to form an area for suitable for vacuum opening of the bag. Most preferably, when both the wicket top and the vacuum opening features are applied, the film strip for wicketing is heat sealed to a longer section of fabric extending from the fold with a portion of the strip suitable for being provided with holes to receive a wicket extending beyond the end of the substrate, and the film strip for vacuum opening is heat sealed to the shorter section of substrate extending from the fold such that the end of the substrate opposite the fold extends slightly beyond the strip.

Preferably, the method of the present invention provides for the manufacture of heat-sealable seam bag stock from open mesh fabric comprising providing a continuous single layer of a heat sealable open mesh fabric, advancing the fabric in a machine direction, providing a double width roll of print band material, advancing and slitting the print band material in the machine

direction to form two equal width print bands, attaching the print bands to the open mesh fabric on each side of a machine direction centerline of the open mesh fabric at equal distances from the centerline, providing a polymeric film of predetermined width and capable of being heat sealed to the open mesh fabric, positioning the film relative to the open mesh fabric with the width of the film disposed transversely to the machine direction, stopping the advancement of the open mesh fabric and the polymeric film in registration with an intermediate station at which a leading edge of the polymeric film in the transverse direction is heat sealed to a second side of the open mesh fabric and the polymeric film is cut parallel to the leading edge to form a heat-sealable seam bag stock, advancing the heat-sealable seam bag stock from the intermediate station and resuming advancement of the open mesh fabric and polymeric film to the intermediate station, and taking up the heat-sealable seam bag stock.

In the above-described embodiments of the invented process, advancement of the substrate and bag stock or bags in progress in the longitudinal, or machine, direction is interrupted intermittently to stop and restart advancement of the material. This interruption is timed to coincide with one or more intermediate stations of the apparatus for performing various operations while the substrate or intermediate products are stopped. Restarting the advancement after those operations are completed removes the substrate or intermediate product from the station and advances upstream material thereto for performance of the operations on a next portion of the material. Thus, during stoppage of the advancement, operations including cutting and sealing of the film strips, heat sealing to form seams, finished bag cutoff, wicketing and the like are performed and then the advancement resumes. The intermittent interruption or advancement is accomplished based on indicators disposed on the print band material. A registration means, including sensing device operated in conjunction with the machine drive system, reads or senses the indicators and controls the starts and stops of advancement along the line. Thus, the invented apparatus

includes a means for reading the indicators and stopping and starting advancement of the substrate in the machine direction so that advancement is interrupted with the substrate or bag stock prepared therefrom in registration with means for cutting and heat sealing the film at edges thereof, heat sealing the film strips to form seams, cutting bag stock into individual bags or bag blanks, and the like. A preferred means for effecting the intermittent starting and stopping of advancement of the substrate and bag stock or bags in progress is a photoelectric sensor, most preferably equipped with registration eye, adapted to read the series of markings or other indicators printed or otherwise applied to the print band; however, other suitable means, such as mechanical detectors working in association with notches, perforations or other indicators applied regularly along the length of the print band material are also contemplated.

The above aspects of the invented process and apparatus are illustrated in the drawing. Referring to Fig. 4, there is shown a machine 60 for producing heat-sealable seam bag stock. A roll 78 of continuous open mesh fabric 40 is unwound by drive 62 in a continuous manner. Polymer film 86 in a continuous roll form for use as polymeric sealing tape between layers of open mesh fabric to form improved strength seams is supplied from roll 76. A predetermined length (which corresponds to width measurement 54 in Fig. 3) of polymer film 86 is advanced by servo draw rolls 64. The advancement of open mesh fabric 40 is intermittently interrupted to allow for the formation and attachment of polymer film strip 50 to open mesh fabric 40 by tack heat sealing the leading edge of polymer film 86 with tack sealer 92 and cutting polymer film 86 at the predetermined length by engaging upper knife clamp 94 with knife assembly 96 to sever polymer film 86 at the desired predetermined length of film which becomes width measurement 54 of the polymer film strip 50. At substantially the same time the continuous open mesh fabric 40 is stopped to allow formation of polymer film strip 50 and to tack seal polymer film strip 50 to open mesh fabric 40. In addition, the print bands 48 supplied by print band system 100 are heat

sealed to the intermediate stock 39. Print bands 48 are formed by splitting the double width roll 88 of print band material into two equal width print bands 48 by slitter 106. Print band system 100 is described in more detail in the description of Fig. 5 and Fig. 6. Machine control system 72 utilizes a user-friendly touch screen operator interface, digital selection of converting set up parameters, individual job parameter storage and retrieval, with print off of screens for off line job data storage and diagnostic capabilities. Servo tool drive system 74 in conjunction with machine control system 72 and registration system 84 utilize servo draw rolls 66 to halt advancement of the intermediate open mesh fabric 39 and servo draw roll 64 to stop advancement of polymer film 86 to allow the attachment of polymer film strips 50 and heat sealing of print bands 48 and polymer film strips 50 to the intermediate open mesh stock web 39 while at the same time permitting continuous unwinding of roll 78 and continuous winding of roll 79. Registration system 84 employs a photoelectric cell to detect registration marks on the print bands 48 in order to move intermediate stock web 39 the required predetermined distance for attaching the leading edge of the polymer film 86 to the intermediate stock web 39 and cutting off the polymer film 86 at the predetermined length to form the polymer film strip 50. At the same time and at a separate station polymer film strip 50 with is heat sealed with heat sealer 82.

Fig. 5 shows a print band system in greater detail. Print band system 100 is supported by print band system support 104 and print band roll support 102 attached to support base 103. A double width roll 88 of print band material is unwound and slit by slitter 106 to form two continuous print bands 48. After the double width print band roll 88 is slit, each single print band 48 is pulled through slot 103 (shown in Fig. 6) in v-shaped turning plate 110 thereby turning each print band 48 ninety degrees to the machine direction. The left print band 48 is fed outwardly to left upper turning roll 112, the print band 48 is then turned downwardly to left lower turning roll 114 and then turned inwardly and ninety degrees on left lower turning plate 124 so that print band 48 is running parallel to

the machine web line. Print band 48 is drawn toward open mesh fabric 40 with draw rolls 70. In like manner, the right print band 48 is fed outwardly to right upper turning roll 116, turned inwardly and ninety degrees on right lower turning plate 126 and drawn toward open mesh fabric 40 with draw rolls 70.

Fig. 6 shows a top view of the print band system 100 with double width print band material roll 88 and slitter 106. After the print bands 48 are formed by slitter 106 they are pulled through slots 103 of top turning plate 110 thereby turning the print bands by 90 degrees to the machine line. After running over rolls 112 and 116, rolls 114 and 118 (not shown) and lower turning plates 124 and 126, respectively, print bands 48 are turned 90 degrees so as to be running parallel to the machine direction.

Fig. 7 shows in additional detail a preferred polymer film strip application system, designated 90, which is used to produce an intermediate continuous stock material 39 by applying polymer film strip 50 to open mesh fabric 40. A continuous polymer film 86 is supplied from polymer film roll 76 (not shown) and a predetermined length of polymeric film (width measurement 54 of polymer film strip 50 as shown in Fig. 3) is fed forward by polymer film strip draw rolls 64 and bursts of air are emitted from upper air stripper 98 and lower air stripper 99 to maintain the predetermined length of polymer film 86 in the proper position relative to the open mesh fabric 40.

In Fig. 8, polymer film strip tack sealer 92 is shown in the position to seal a leading edge of polymer film 86 onto the open mesh fabric 40 while knife assembly 96 is simultaneously raised to meet the upper knife clamp 94 and sever the polymer film 86 at the predetermined length to form the polymer film strip 50 having a width distance 54 (shown in Fig. 3).

Fig. 9 illustrates additional detail of a machine 140 for producing open mesh bags from heat-sealable seam bag stock 45 in accordance with the present invention. A roll 46 of heat-sealable seam bag stock 45 is unwound by driv rolls 144 in a continuous manner. Drive rolls 144 draw stock 45 through a

folder 142 to fold stock 45 to a predetermined width of fabric typically about one half the width of the fabric to form a fold which forms the bottom or butt end of a bag. Optionally, folder 142 can have a bottom gusset-forming attachment. For flat top bags the length of fabric extending from each side of the fold is the same. For bags to which polymer strips are added to supply support for wicketing or vacuum opening, or for bags that are provided with a wicket holes in the substrate without polymer film strip reinforcement, fabric from one side of the fold preferably extends further than that from the other side of the fold. The longer section of fabric extending from the fold most preferably accepts the polymer strip for the wicket top and the shorter section most preferably accepts the polymer film strip that is used by produce-filling machines for vacuum opening the formed bags. Following drive rolls 144 the longer section of folded stock 45 for bags without polymer film reinforcement may have wicket holes punched by wicket punch 146. For bags with polymer film reinforcement, polymer film can be supplied to folded stock 45 from polymer film roll 148 powered by polymer film roll unwinder 149. Polymer film strip 170 can be slit in the machine or longitudinal direction into two equal width film strips with a slitter (not shown). These polymer strips can be attached to the top edges of folded stock 45 with polystrip sealer 150. In a separate application, tube stock to be used as form, fill and seal stock can have a back seam sealed by polystrip sealer 150 as a back seam sealer. The advancement of folded stock 45 is intermittently interrupted to allow attachment of the polymer strips to the top edges of stock 45 with polystrip sealer 150. At the same time the polymer strips are being heat sealed to stock 45, servo draw roll 162 stops the forward movement of stock 45 and cross seams are heat-sealed by cross seam sealers 152 and the polymer strip is attached to the longer section of folded stock 45 at the previous station has a wicket hole or holes formed by wicket punch 154. Machine control system 172 utilizes a user-friendly touch screen operator interface, digital selection of converting s t up parameters, individual job parameter storag and retrieval, with

print off of screens for off line job data storage and diagnostic capabilities. Servo tool drive system 174 in conjunction with machine control system 172 and registration system 156 utilize servo draw rolls 162 and 164 to halt advancement of the intermediate open mesh fabric 39 between servo draw rolls 162 and 164 and drive rolls 144 to allow the attachment of polymer strips and heat sealing of crosswise disposed seams by sealer 152. Registration system 84 employs a photoelectric cell to detect registration marks on the print bands 48 in order to set the distance for moving folded stock 45 for heat sealing cross-web seams with cross-seam sealer 152.

The product of machine 140 is collected in product collection system 160. For the option in which the bags are formed in a continuous roll, the heat-sealable seam bag stock 45 is folded, cross seams are sealed with cross-seam sealer 152, a bottom gusset is optionally formed and stock 45 is left in continuous form without forming individual bags. A windup roll is provided as the product collection system 160. This continuous roll can be later cut to form individual bags. For the option in which individual heat-sealed side seam bags with either a flat top or wicketed top feature are formed, a draw roll and bag cut-off mechanism are provided including a servo driven draw roll, air assist bag delivery nozzles, static eliminator and a guillotine-style bag cut-off knife. The individual bags are stacked and collected in product collection system 160. For the option in which individual heat-sealed side seamed bags with a wicketed top feature are formed, an automatic wicket top stacking conveyor may be provided which includes servo driven pickup arms, four-station exposed wicket stacking conveyor and pin designed for wicket wire removal. In this embodiment of the invention, the method and apparatus can provide bags in the form of a stack made up of a plurality of bags disposed on a wicket. The wicket generally is in the form of a wire or rod having two right angle bends and adapted to receive and hold in place the bags by means of holes punched or otherwise made in the closed end of the bags.

A preferred apparatus for manufacture of bag stock for making the invented bags, comprising sealing strips of a thermoplastic resin affixed to one surface of an open mesh fabric at selected locations, and optionally a printed or printable label secured to the same or an opposing surface of the fabric, comprises, in combination, means for advancing each of a bag substrate, thermoplastic polymeric film and print band from sources thereof continuously through the apparatus such that the film is brought into contact with one side of the substrate and the print band is brought into contact with the same or an opposing side of the substrate; means for intermittently stopping and resuming passage of the substrate, film and print band through the apparatus based on indicators detectable from the print band; a strip applicator disposed in the path of the substrate and the film comprising means for transversely affixing a leading edge of the film to the substrate and means for transversely cutting the film at a selected distance upstream of the leading edge thereof; a heat sealing device located in the path of the substrate and the print band downstream of the point at which the substrate contacts the print band for longitudinally heat sealing the print band to the substrate; and takeoff means for continuously removing bag stock from the apparatus. Preferably the print band is advanced through the apparatus from a double width roll of print band material by means of a braked unwind shaft, with a cutting blade or other suitable slitting device positioned in the path of the print band for cutting it into two bands, each of which is advanced through adjustable position dual turn bars onto the substrate at equal distances from the centerline thereof. A preferred strip applicator device includes means for directing bursts of air or other suitable fluid at the film from one or both sides of the substrate to assist in positioning the film relative to the substrate. Cutting of the film is preferably accomplished using a reciprocating knife blade - blade clamp assembly adapted to intermittently close on the film to cut it and open simultaneously with resumption of advancement of the substrate. Most preferably, the knife blade ass mbly includes means for heating the blade for

smoother cutting. Simultaneously with cutting of the film, a leading edge of the film is affixed to the substrate, most preferably using a heat seal bar located such that it contacts the film in contact with the substrate.

A preferred embodiment of the invention, described with reference to FIGS. 4-8, involves manufacture of bag stock from which open mesh bags can be formed either in line or in a separate operation. Referring to FIG. 4, a roll 78 of continuous open mesh fabric 40 is unwound by web drive 62 in a continuous manner. Polymer film 86 in continuous roll form is supplied from roll 76. A predetermined length of film 86 is advanced by servo draw rolls 64. The advancement of open mesh fabric 40 is intermittently interrupted to render the fabric stationary at an intermediate station at which formation and application of polymer film strip 50 are accomplished using a strip applicator assembly. Thus, a leading edge of film 86 is tacked, or lightly heat sealed, to the fabric by tack sealer 92 while the film is simultaneously cut at a predetermined position, corresponding to the width of the affixed sealing strip, by engaging upper knife clamp 94 with knife assembly 96 to sever the film. The resulting intermediate bag stock 39, comprising fabric with affixed sealing strips, advances through the apparatus for subsequent application of print bands 48. The print bands are supplied by print band system 100 and are heat sealed to the intermediate bag stock 39. Each print band is formed by splitting material from double width roll 88 of print band material into two equal width bands 48 using slitter 106. Heat seal means for affixing a trailing edge of polymer film strip to the substrate to facilitate subsequent handling and processing of the bag stock is conveniently located in the vicinity of the print band heat seal means.

Advancement of materials through the apparatus with intermittent stoppage at intermediate stations equipped with the strip applicator and the heat sealing device and resumption after they perform their respective operations on each section or portion of the materials that advance to and through them is affected by machine control system 72 operated in conjunction with drive system

72 and photoelectric registration system 84 . The machine control system utilizes a user-friendly touch screen operator interface, digital selection of converting set up parameters, individual job parameter storage and retrieval, with print off of screens for off-line job data storage and diagnostic capabilities. Servo tool drive system 74 in conjunction with machine control system 72 and registration system 84 utilize servo draw rolls 66 to halt advancement of the intermediate open mesh fabric 39 for cutting and attachment of polymer film strips 50 and heat sealing of print bands 48 to the intermediate open mesh stock 39 while at the same time permitting continuous unwinding of roll 78 and continuous winding of roll 79. Registration system 84 employs a photoelectric cell to detect registration marks printed or otherwise applied on the print bands 48 in order to move intermediate stock 39 a predetermined distance to a station for attaching the leading edge of polymer film 86 to the intermediate stock 39 and cutting off the polymer film 86 at the predetermined length to form the polymer film strip 50. At the same time and at a separate station, polymer film strip 50 is heat sealed with heat sealer 82.

In this preferred embodiment, the print band system, best seen from Fig. 5, includes support 104 and print band roll support 102 attached to support base 103. Material from a double width roll 88 of print band material is slit by slitter 106 into two continuous print bands 48. After the double width print band from roll 88 is slit, each single print band 48 is pulled through slot 105 (seen in FIG. 6) in v-shaped turning plate 110 to turn or redirect each of the individual bands 48 ninety degrees to the direction of advancement through the machine. The left print band 48 is fed outwardly to left upper turning roll 112, the print band 48 is then turned downwardly to left lower turning roll 114 and then turned inwardly and ninety degrees on left lower turning plate 124 so that the band runs parallel to the direction of advancement through the machine. Print band 48 is drawn toward open mesh fabric 40 with rolls 70. In like manner, the right print band 48 is fed outwardly to right upper turning roll 116, turned inwardly and ninety

degrees on right lower turning plate 126 and drawn toward open mesh fabric 40 with rolls 70.

The strip applicator in this embodiment of the invention, best in Fig. 7, functions to produce a continuous intermediate bag stock 39 having polymeric film strip heat sealed at an edge thereof across part of the width of the fabric by cutting a polymer film strip 50 and securing it to open mesh fabric 40. The continuous polymer film 86 is supplied from the polymer film roll (not shown in FIGS. 7 and 8 but represented by reference character 76 in FIG. 4) and a predetermined length of the film is fed forward by polymer film strip draw rolls 64. Bursts of air emitted from upper air stripper 98 and lower air stripper 99 aid in precise positioning of the polymer film 86 relative to fabric 40. Referring to FIG. 8, strip tack sealer 92 is shown in the position to seal the leading edge of polymer film 86 to fabric 40. At the same time, knife assembly 96 is raised to engage upper knife clamp 94 and thereby sever film 86. Referring to the bag stock illustrated in FIG. 3, the distance between the knife assembly and tack sealer, and in turn the length of the cut film, correspond to the width -- that is, the shorter dimension -- of strips 50.

FIG. 9 illustrates a preferred machine 140 for producing open mesh bags from bag stock such as that made as described above. A roll 46 of bag stock 45 with heat sealable film strips is unwound by drive rolls 144 in a continuous manner. Drive rolls 144 draw stock 45 through a folder 142 to fold the stock to a predetermined width. As described above, that width can be about one half the width of the fabric, with equal lengths of fabric extending from each side of the fold, or it can be greater than half the width of the fabric, as where longer and shorter sections of fabric extend from each side of the fold and are utilized for application of film strips for wicketing, sealing or other special features. Optionally, folder 142 can also have a bottom gusset-forming attachment.

For bags that are to be punched with wicket holes in the fabric itself, as opposed to in a polymer film strip attached to the fabric, the folded bag stock

exiting folder 142 passes between drive rolls 144 to wicket punch 146 which punches holes in the longer side of fabric extending from the fold. For bags in which wicket holes are to be punched in polymer film attached to the fabric, polymer film is supplied to the folded bag stock from film roll 148 which is driven by film roll unwinder 149. Polymer film 170 can be slit in the machine direction into two film strips with a slitter. The film or strips are attached to the top edges of the folded stock 45 with strip sealer 150. Advancement of the folded bag stock is intermittently interrupted for attachment of the polymer strips to the top edges of the stock 45 with strip sealer 150. Simultaneously with heat sealing of the strips to the folded stock, servo draw roll 162 stops the forward movement of the folded stock, cross seams are heat sealed by cross seam sealers 152 and the polymer strip attached to the longer side of the fabric in the previous cycle has a wicket hole formed by wicket punch 154. Machine control system 172 utilizes a user-friendly touch screen operator interface, digital selection of converting set up parameters, individual job parameter storage and retrieval, with print off of screens for off-line job data storage and diagnostic capabilities. Servo tool drive system 174 in conjunction with machine control system 172 and registration system 156 utilize servo draw rolls 162 and 164 to halt advancement of the material between servo draw rolls 162 and drive rolls 144 to allow the attachment of polymer strips and heat sealing of cross seams by sealer 152. Registration system 156 employs a photoelectric cell to detect registration marks on the print bands 48 to regulate the distance for moving the folded stock to and from the station at which heat sealing the cross seams with cross-seam sealer 152 is performed.

The product of machine 140 is collected using collection system 160. The product can be collected as a continuous roll without forming individual bags using a windup roll as the collection system. The resulting continuous roll can be cut to form individual bags in a subsequent operation. In another embodiment, individual heat-sealed side seam bags, with either a flat top or wicketed top, are

formed on the apparatus. In this embodiment, a draw roll and bag cut-off mechanism are provided including a servo driven draw roll, air assist bag delivery nozzles, static eliminator and a guillotine-style bag cut-off knife. The individual bags are stacked and collected in product collection system 160. If individual heat-sealed side seam bags with a wicketed top are to be formed, an automatic wicket top stacking conveyor, which includes servo driven pickup arms, four-station exposed wicket stacking conveyor and pin designed for wicket wire removal, can be provided. In this embodiment bags are provided in the form of a stack made up of a plurality of bags disposed on a wicket.

In the above-described embodiments, the open mesh fabric most preferably is fed to downstream processing from a single position, center-driven unwind stand. Print band material is most preferably supplied from a braked unwind stand. Razor slitters are most effectively utilized for cutting the double width print band, polymeric film and bag stock. Solid and profiled face heat seal bars, preferably constructed from aluminum are well suited for heat sealing operations, with the solid face sealers being best suited for sealing of the print band to the substrate and profiled sealers being well suited for sealing of the film strips to the substrate. Tack sealing of the film strip at its leading edge to the substrate is most preferably performed using a nichrome wire strip tack sealer. For folding the substrate with applied film strips, any suitable in-line web folder can be employed. Wicket holes are suitably formed using pneumatic hole punches. Persons skilled in the art will appreciate that alternative equipment can be utilized in the invented process and as part of the apparatus with good results.

An example of an open mesh bag that can be produced by the method and apparatus of the present invention formed from a flat, open mesh substrate, preferably a nonwoven mesh-like material, is illustrated in Fig. 1. Bag 10 is constructed of an open, mesh-like fabric that defines a product-containing space with the bag having a bottom fold 12 form d by a fold in the fabric on a central

axis between side seams 14 and 16 with side seams 14 and 16 of bag 10 heat-sealed. Fig. 2 shows the construction of bag 10 in cross-sectional view. Front 18 and back 20 of bag 10 with side seams 14 and 16 are shown with edges 22 and 32 of front 18 and edges 28 and 38 of back 20 of bag 10 and heat-sealable film strips 26 and 36. Side seam 14 is shown with edge 22 of front 18 having a heat seal between edge 22 and heat-sealable film strip 26. Polymer film strip 26 also has a heat seal to edge 28 of back 20 of bag 10. In a like manner, side seam 16 is shown with edge 32 of front 18 having a heat sealed edge 32 and polymer film strip 36. Polymer film strip 36 also has a heat seal that seals strip 36 and edge 38 of back 20 of bag 10.

Heat sealed side seams 14 and 16 can be as wide as necessary to effectively bond the edges of the open mesh bag and heat-sealable strips together. In general, heat-sealed side seam widths of between 1/4 inch and 1 inch are preferred, and a seam width including the width of the heat-sealable film strip of 1/2 inch is, depending again on the size of the bag and its application, most preferred.

Fig. 3 shows a roll 46 of heat-sealable seam bag stock 45 produced in accordance with the method and apparatus of the invention. The roll 46 of heat-sealable seam bag stock 45 includes a continuous single layer web of a heat sealable open mesh fabric 40 and a plurality of substantially equally spaced polymeric film strips 50 spaced apart by a distance 56. Each polymeric film strip 50 is a layer of polymeric film capable of being heat sealed to strip-free regions 44 of the open mesh fabric 40 after the fabric is folded. The polymeric film strips have a width measurement 54 and a length measurement 58. The heat-sealable film strips 50 extend across approximately one half the width of fabric 40, so that when the fabric is folded on a central axis the film strip extends to the full height or length of a bag made from the heat-sealable seam bag stock 45 and strengthens the seams made upon heat sealing two layers of the open mesh

fabric together with the polymeric film strip 50 between the layers. Fig. 3 also shows print bands 48 attached to the open mesh fabric 40.

The method and apparatus of the present invention for production of heat-sealed seam bags and stock for making such bags can use, in general, any heat-sealable fabric or substrate suitable for processing into bags having a flat construction and capable of having heat-sealable strips attached to the fabric or substrate wherein the strips can be heal-sealed between layers of the substrate resulting from folding the same to form high integrity seams. The substrate can be a solid or perforated film, woven or knitted fabric, scrim or extruded netting or an open, mesh-like or net-like nonwoven fabric. Preferred substrates are woven and knitted fabrics, scrims, extruded nets and netlike nonwoven fabrics having sufficient openness of construction to allow adequate visibility of a bag's contents. Preferred fabrics also have elongation (ASTM D1682) less than about 30%; Elmendorf tear strength (ASTM D689) of at least about 300g; and breakload (ASTM D1682) of at least about 15 lb/in. More preferably, to facilitate processing using the invented bag stock and bagmaking machinery or method, such open mesh fabrics also have a coefficient of friction according to ASTM 3334-80 Section 15 of less than about 30° and dimensional stability such that the fabric, when folded and seamed, can withstand a force of at least about one g without substantial deregistration. Most preferred fabrics have coefficients of friction of about 15° to about 25° and can withstand g forces of at least about 2 without substantial deregistration.

Woven and knit fabrics can be constructed and prepared in any suitable manner. From a cost and performance standpoint, so-called tapes or slit-film ribbon yarns are preferred for such fabrics. Any suitable weave or knit providing an appropriate level of openness to impart breathability of the fabric and visibility of a bag's contents can be utilized. Examples include flat and leno weave fabrics and knitted fabrics. Such fabrics also can be employed with coatings or heat sealing to provide enhanced dimensional stability and fray r sistance to the

same. Of course any such coating must be applied to the fabric in a discontinuous manner, that is, so that less than the entire surface of the fabric is coated, in order to ensure that the coated fabrics have adequate breathability. Various techniques for discontinuous coating of fabrics are well-known. An example is stripe coating as disclosed in U. S. 4,557,958. Heat sealing also can be utilized to improve dimensional stability of such fabrics, as will be appreciated by persons skilled in the art. In the case of these fabrics, whether a leno weave, flat weave, knit or otherwise, the yarns of the fabric or such yarns and any coatings will generally comprise a thermoplastic resin composition. It also is contemplated to form the fabric or coated fabric from thermoplastic resin compositions having different melting points, with a higher melting resin being present to provide strength and integrity to the fabric and a lower melting resin being present, either as a discontinuous coating on the surface of the fabric or laminated to or as part of the yarns thereof, e.g., as bicomponent yarns or coextruded tapes, to provide for heat bonding of the yarns of the fabric to other yarns and, in turn, greater dimensional stability and resistance to fraying. Like considerations are applicable to scrims.

Nonwoven netlike fabrics, extruded nets and scrims are also suitable as open mesh fabrics for use with the invented equipment and according to the invented method. These materials typically have a reticulated or netlike structure, with a plurality of interconnected, intersecting fibrils or ribs defining a plurality of open spaces in the fabric. The fibrils preferably are disposed in a regular pattern, thereby forming a grid that defines the open spaces. Depending on the pattern formed by the fibrils, the open spaces may all be the same size and shape or they may be of different sizes and/or shapes. The netlike webs comprise one or more thermoplastic resin compositions or formulations. These materials can be made by various means such as thermally bonding a series of filaments laid down in a predetermined pattern, controlled slitting and/or splitting and stretching of film-forming thermoplastic resin compositions to achieve a

netlike structure and others. Lamination of two or more such structures can be employed to provide materials of greater strength than single layer structures. When one or more of the layers is oriented only uniaxially, cross-lamination with at least one layer oriented perpendicularly to orientation of at least one other layer is particularly effective for imparting strength.

Preferably, the fabric has an open mesh-like construction; more preferably it is a nonwoven mesh-like material. Most preferably, the bags are formed from a cross-laminated nonwoven fabric made from coextruded film that has been split and stretched. Preferably, such coextruded film can comprise a layer of high density polyethylene and a layer of low density polyethylene. A preferred form of mesh-like material for construction of open mesh bags by the method or apparatus of the present invention is a so-called "cross laminated airy fabric," also known by the Nippon Petrochemical Company Ltd. trademark CLAF®. This material can be characterized as a net-like web or nonwoven and is described in detail in U. S. 5,182,162 and 5,300,345. These cross-laminated thermoplastic net-like fabrics, sometimes also referred to as webs, are available from Amoco Nisseki CLAF, Inc. under the designation of CLAF® with examples of product designations including CLAF S, CLAF SS, CLAF HS and CLAF MS. Such fabrics are available in various styles and weights. Properties of such fabrics that make them well suited materials of construction for the open mesh bags produced by the method and apparatus of the present invention include a coefficient of friction of about 20°, dimensional stability sufficient to withstand acceleration of at least about 3 g without significant deregistration, high strength, openness for breathability and visibility and excellent aesthetic properties for bag applications.

In a particularly preferred embodiment, a MS grade CLAF® fabric is utilized as a substrate and an ethylene alpha-olefin polymer, such as that identified as Affinity PF 1140 from Dow, is used for the thermoplastic film. A heat seal temperature of about 360° to 400°F, total dwell tim of about 0.1 to 0.5 sec

seconds and a pressure of about 40 to 60 psi preferably are used to heat the thermoplastic film and open mesh fabric to effect the seal at the seams. Typically the CLAF® fabrics can be supplied in roll widths up to 60 inches or more. At open mesh fabric widths of 60 inches the maximum bag height or length is 30 inches. The bag width can be up to 24 inches. Processing speeds of the open mesh fabric can be as high as 300 feet per minute and the registration system can handle converting speedup to 150 cycles per minute.

More generally, the thermoplastic net-like webs preferred as substrates according to the invented process are generally made from film forming materials made into film which, for cross-laminated thermoplastic net-like webs, are oriented, slit and laminated together. Among the film forming materials which can be employed in making the cross-laminated thermoplastic net-like webs are thermoplastic synthetic polymers comprising one or more olefin such as low density polyethylene, linear low density polyethylene, polypropylene, high density polyethylene, random copolymers of ethylene and propylene and combinations of these polymers; polyesters; polyamides; polyvinyl polymers such as polyvinylalcohol, polyvinylchloride, polyvinylacetate, polyvinylidene-chloride and copolymers of the monomers of these polymers. Preferred materials are polyesters and polyolefins such as polypropylene, random copolymers of propylene and ethylene, and a combination of high density polyethylene and low density polyethylene.

These thermoplastic synthetic polymers may contain additives such as stabilizers, plasticizers, dyes, pigments, anti-slip agents, and foaming materials for foamed films and the like.

Whether the substrate is a woven, knitted or scrim material or a nonwoven, preferred thermoplastic resins therefor are polyolefins such as polypropylene, polyethylene and copolymers of propylene and polyethylene. High, medium, low and linear low density polyethylenes are contemplated. Preferred combinations of resins are polypropylene for strength or load-bearing

components of the fabric and polyethylene or blends thereof with polypropylene for the heat-sealable components thereof and high density polyethylene for the strength or load-bearing components and low density polyethylene for the heat-sealable components.

The thermoplastic film strips employed in formation of the heat-sealable side seams of the open mesh bags produced by the method and apparatus for manufacture of the present invention most preferably has a lower melting or heat initiation temperature than the melting temperature of the open mesh fabric, and especially the higher melting component of fabrics comprising bicomponent resin compositions, and should also provide sufficient seal strength and adhesion to allow the bags to hold product without breaking or failure at the seams during filling and handling. The film strips are applied to approximately one half the width of the fabric, so that when the fabric is folded, the film strip will extend longitudinally along the full length or height of the bag. The exact length of the film strip across the width of the fabric will depend on the closing mechanism employed for closing the bag with the length of the strip being somewhat less than half the width of the fabric if an overlap of bag fabric material is used to close the open end of the bag. In the case where the bags are gusseted with a one inch deep gusset, for example, the film strip preferably is applied at a distance about one inch more than one half the width of the fabric so that each layer in the gusset is touching the film.

The choice of thermoplastic resin used to make the heat-sealable film will depend in part upon the amount of heat and pressure that can be applied to the thermoplastic film at the side seam of the open mesh bag without impacting the integrity of the open mesh bag. Any suitable thermoplastic resin may be used to manufacture the heat-sealable film strip but the resin preferably is one having a lower melting temperature or heat initiation temperature than the melting temperature of the substrate material. The thermoplastic resin may be a single resin or a blend of two or more compatible resins. The choice of thermoplastic

resin or resins for the film may also depend on the ultimate use of the open mesh bag. In the case where a high density polyethylene ("HDPE") substrate is used, the thermoplastic film strip is preferably an ethylene alpha-olefin polymer or copolymer or blend of compatible polymers having a melting temperature below that of the HDPE.

These thermoplastic synthetic polymer resins may also contain additives such as stabilizers, dyes, pigments, anti-slip agents, foaming agents and the like.

Another consideration in the choice and use of the thermoplastic film strip is its width and thickness. The width and thickness of the film strip must be sufficient to effectively heat seal together the side seams of the open mesh bag. In a preferred embodiment of the invented method, the film strips as applied to the substrate are generally a little more than twice the desired width of the seal for the side seam of the finished bags. The strips and substrate are cut transversely along a centerline of the applied film with the result that two sealable seams are formed in each application of the film strip. For example, a film strip about 1-and-1/4 inch wide can be used and slit to form two, one-half inch wide side seams or seaming strips. The slightly wider film strip is used to ensure that only fabric with heat-sealable film between layers of the fabric is exposed to the heat seal device. Thickness of the film may vary depending on whether the film is a single layer or a multi-layer film. For single layer films, the thickness may be maintained at a thickness just sufficient to effectively heat seal the seams. For multi-layer films, the thickness will vary depending on the characteristics the film is to provide to the heat-sealing of the seams. For example, a multi-layer film may comprise two outer layers of a lower melting temperature resin to enhance heat sealing characteristics and an inner layer of a higher melting temperature resin to strengthen the seam, in which case thickness of the outer layers will be dictated by seam strength and adhesion to the substrate while inner layer thickness will be based on strength of the resin and seam strength requirements of the ultimate finished bags.

While the invention has been described in reference to several preferred or specific embodiments, it will be appreciated by persons skilled in the art that various modifications, alternatives and equivalents are contemplated within the scope of the invention as characterized in the appended claims.

We claim:

1. An apparatus for manufacture of bag stock comprising, in combination, means for advancing each of a bag substrate, thermoplastic polymeric film and print band from sources thereof continuously through the apparatus such that the film is brought into contact with one side of the substrate and the print band is brought into contact with the same or an opposing side of the substrate; means for intermittently stopping and resuming passage of the substrate, film and print band through the apparatus based on indicators detectable from the print band; a strip applicator disposed in the path of the substrate and the film comprising means for transversely affixing a leading edge of the film to the substrate and means for transversely cutting the film at a selected distance upstream of the leading edge thereof; a heat sealing device located in the path of the substrate and the print band downstream of the point at which the substrate contacts the print band for longitudinally heat sealing the print band to the substrate; and takeoff means for continuously removing bag stock from the apparatus.

2. The apparatus of claim 1 wherein the means for intermittently stopping and resuming passage through the apparatus comprises a photoelectric device.

3. The apparatus of claim 2 wherein the strip applicator device comprises a heat seal bar operated in conjunction with a knife and clamp assembly.

4. The apparatus of claim 2 further comprising means for heat sealing the polymeric film to the substrate at or near a trailing edge of the cut film.

5. The apparatus of claim 1 further comprising means for receiving the bagstock after application of the film thereto and folding the bag stock along a centerline thereof and means for heat sealing the folded bagstock at the film to form a seam.

6. The apparatus of claim 5 further comprising means for cutting the bag stock at the seam.

7. An apparatus for the manufacture of bags comprising in combination and in line:

means for advancing in a longitudinal direction a continuous bag stock,

means for receiving the advancing bag stock and folding the bag stock to form a fold in the longitudinal direction,

means for stopping and restarting advancement of the bag stock intermittently in registration with a heat seal device,

a heat seal device for heat sealing the bag stock transversely to the direction of advancement, and

means for collecting a bag stock.

8. The apparatus of claim 7 further comprising means, disposed between the heat seal device and the means for collecting bag stock, for cutting the bag stock transversely to the direction of advancement.

9. The apparatus of claim 7 wherein the means for stopping and restarting advancement of the bag stock comprises a photoelectric sensor.

10. A process for making open mesh bags comprising the steps of applying to an open mesh substrate a print band material bearing a readable indicator and applying to the substrate at selected positions strips of a thermoplastic resin to which the substrate is heat sealable, wherein the positions of the strips are selected based on the indicators on the print band material.

11. The process of claim 10 wherein the print band material is heat sealed to the substrate.

12. The process of claim 10 wherein the print band material is applied to the substrate after the strips of thermoplastic resin are applied to the substrate.

13. The process of claim 10 wherein the strips are heat sealed to the substrate.

14. The process of claim 10 further comprising collecting the substrate with heat sealed strips on a roll.

15. The process of claim 10 further comprising folding the substrate along a central axis such that the axis and the strips are essentially perpendicularly disposed, and heat sealing the substrate from both sides of the fold to the strips to form a seam.

16. The process of claim 15 further comprising applying a polymeric film strip to the substrate extending from a side of the fold at or near an end of the substrate opposite the fold.

17. The process of claim 16 wherein the film strip extends beyond the end of the substrate

18. The process of claim 17 wherein the film strip extending beyond the end of the substrate has holes adapted to receive a wicket.

19. The process of claim 15 further comprising cutting the heat sealed substrate across the seam.

20. The process of claim 10 wherein the substrate comprises a woven fabric.

21. The process of claim 10 wherein the substrate comprises a knitted fabric.

22. The process of claim 10 wherein the substrate comprises an extruded net.

23. The process of claim 10 wherein the substrate comprises a netlike nonwoven.

24. A process for manufacture of open mesh heat-sealed side seam bags comprising the steps of:

folding in a longitudinal direction a continuous heat-sealable seam bag stock comprising an open mesh substrate having a plurality of heat-sealable polymeric film strips affixed to a surface thereof and a print band material affixed to an opposing surface thereof to create two overlapping layers of substrate

extending from the fold with the heat sealable polymeric film strips located between the layers and the print band located on at least one outer side of the folded substrate,

intermittently stopping and restarting advancement of the heat-sealable seam bag stock in registration with a heat seal device and a cutting device,

heat sealing the layers and the polymeric film strip in a cross direction at the heat seal device,

cutting the heat sealable seam bag stock at the heat-seal to produce heat-sealed side seam bags, and

collecting the heat-sealed side seam bags.

25. The process of claim 24 wherein the intermittent stopping and restarting of advancement of the substrate is determined from readings of indicators on the print band material.

26. A process for the manufacture of heat-sealable seam bag stock from open mesh fabric comprising the steps of:

advancing a continuous single layer heat sealable open mesh fabric in a longitudinal direction,

advancing in the longitudinal direction a print band material onto the open mesh fabric,

feeding in the longitudinal direction a polymeric film of predetermined width capable of being heat sealed to the fabric,

positioning the polymer film relative to the open mesh fabric web,

intermittently stopping and restarting the advancement of the fabric in registration with an intermediate station as determined from indicators on the print band,

heat sealing a leading edge of the polymeric film in a cross direction to a side of the open mesh fabric and cutting the polymeric film at a trailing edge to form a bag stock comprising the fabric having affixed thereto polymeric film strips of predetermined length at the intermediate station, and

collecting the bag stock.

27. The process of claim 26 further comprising heat sealing the polymeric film to the fabric at or near a trailing edge of the cut film.

28. The process of claim 27 further comprising folding the bag stock to form a longitudinal fold extending in the direction of advancement of the fabric and heat sealing the fabric from both sides of the fold to the film strips to form seams.

29. The process of claim 28 further comprising collecting the heat sealed fabric.

30. The process of claim 28 further comprising cutting the heat sealed fabric transversely to the direction of advancement at the seams to form bags.

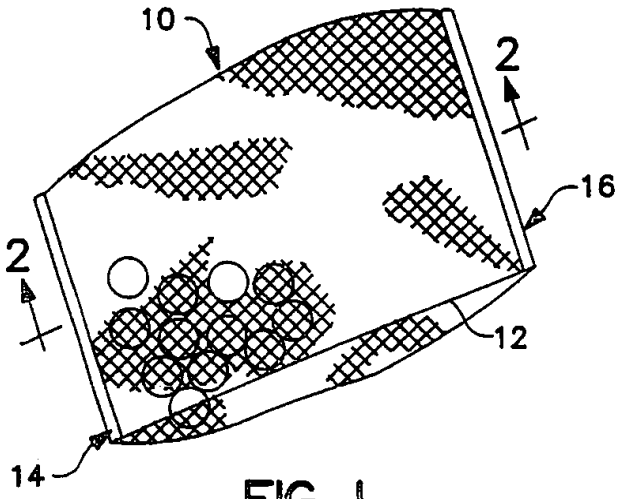


FIG. 1

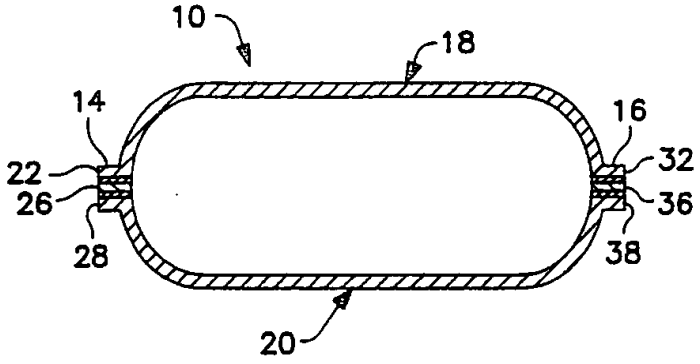
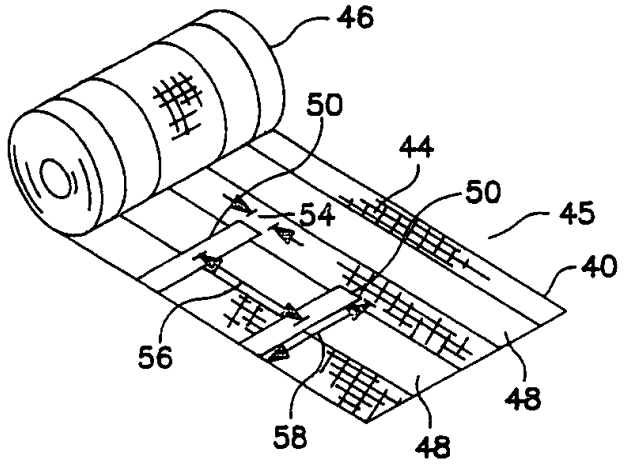


FIG. 2



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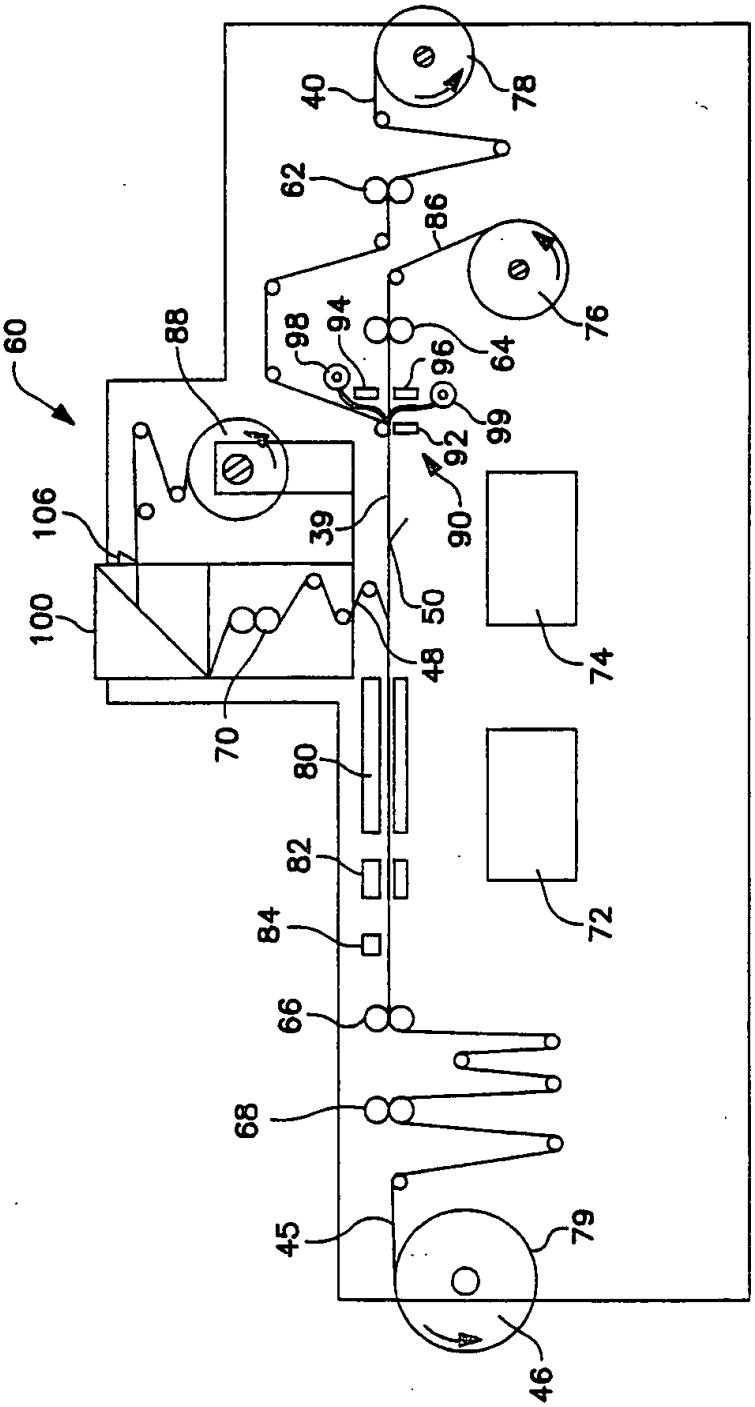
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FIG. 4

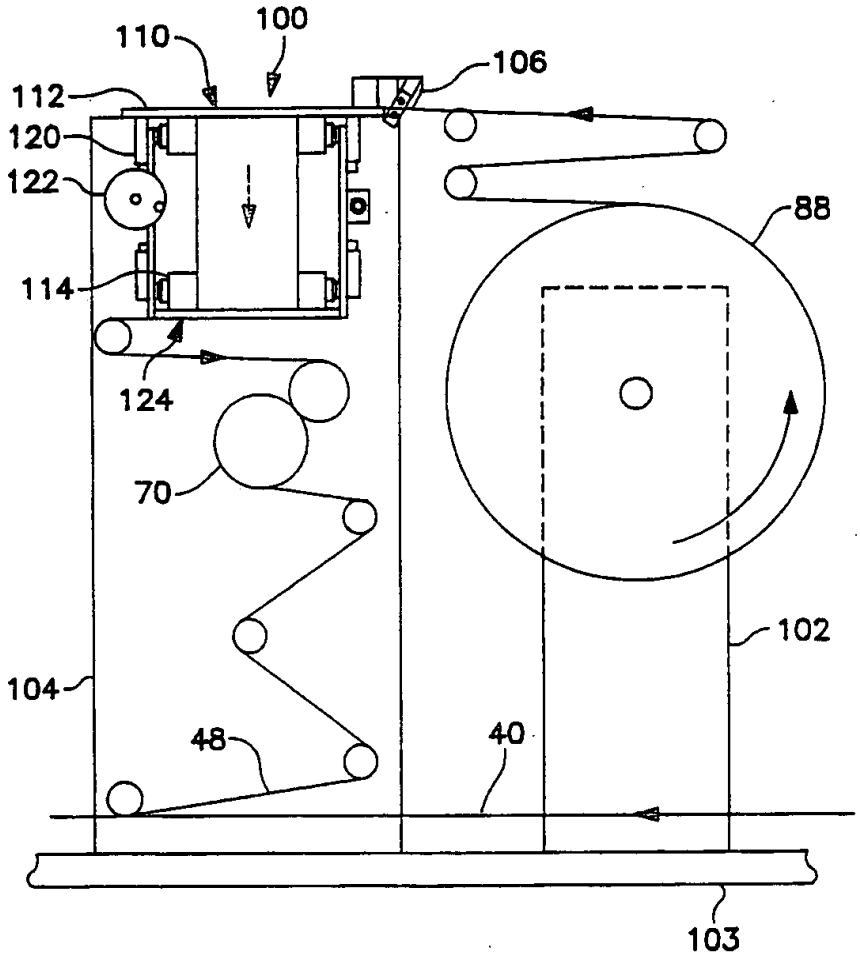

FIG. 5

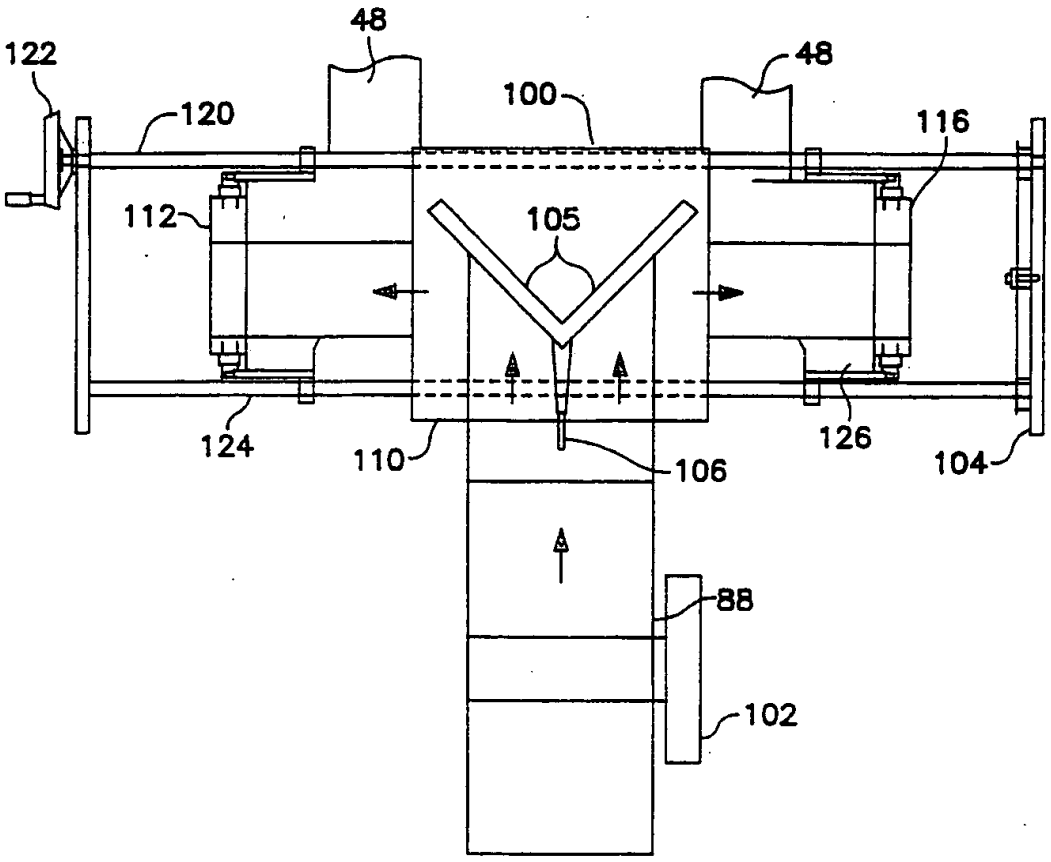

FIG. 6

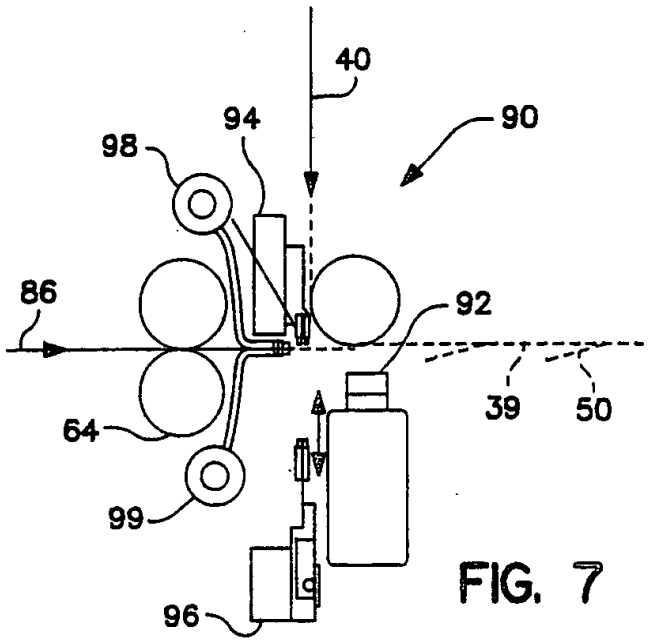

FIG. 7

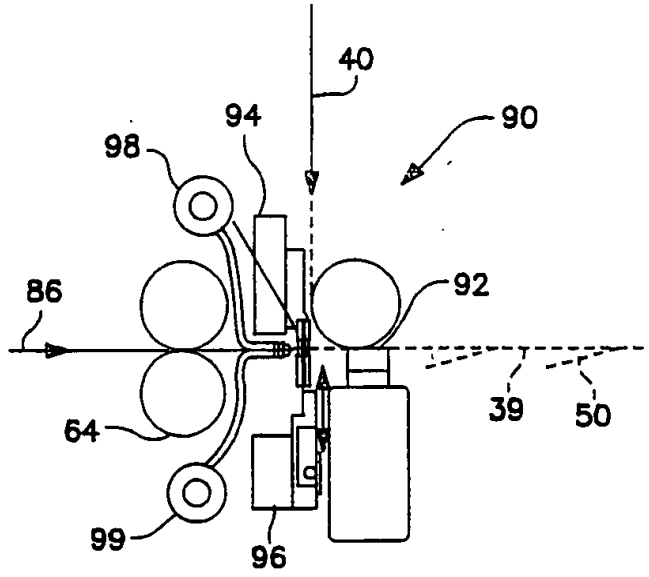

FIG. 8

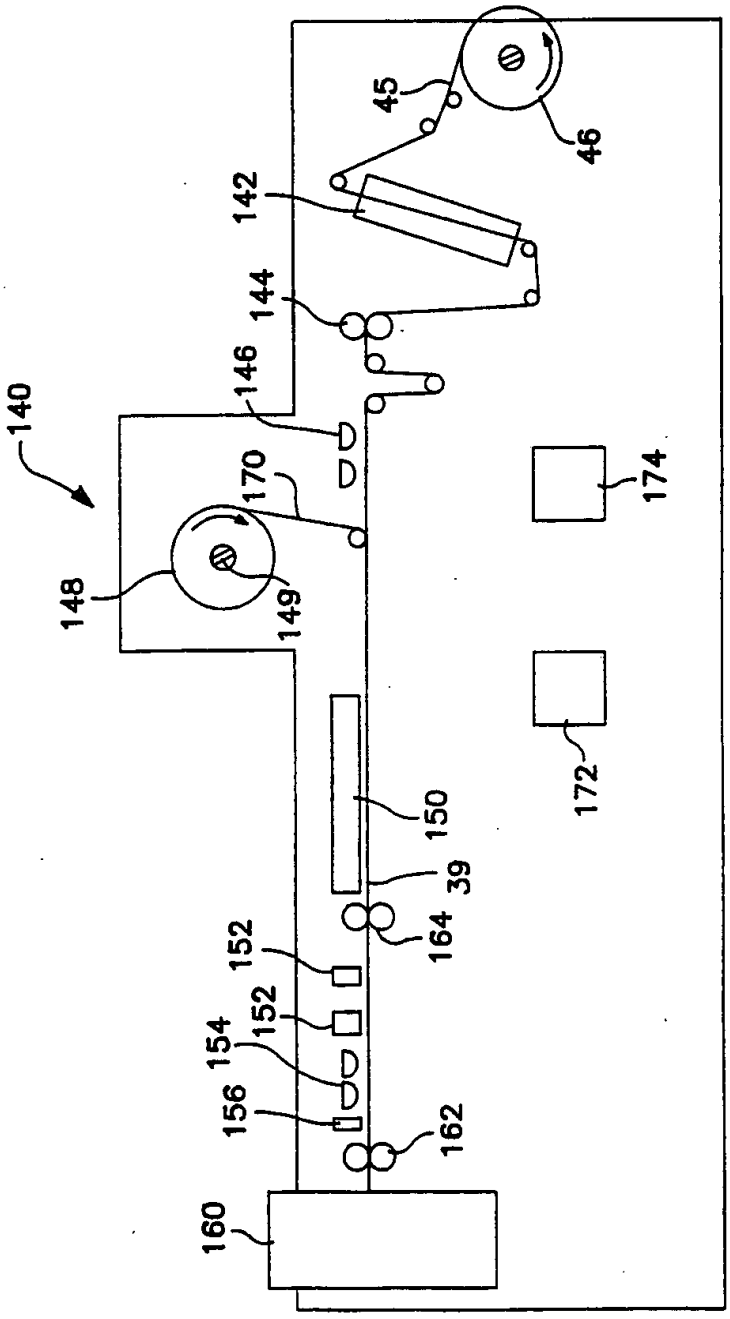
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FIG. 9

INTERNATIONAL SEARCH REPORT

Inte Jonal Application No
PCT/US 99/10760

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B31B19/90 B31B19/60 B31B19/10 B65D30/06

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B31B B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	US 3 970 503 A (YOSHIMURA TAKEHISA) 20 July 1976 (1976-07-20) claims 1,4; figures	1
A	DE 20 02 445 A (GEBR. HÖLLER GMBH) 29 July 1971 (1971-07-29) claims	1
A	US 3 257 915 A (CARTIER PIERRE ET AL) 28 June 1966 (1966-06-28) cited in the application	

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents :

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"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
19 August 1999	30/08/1999

Name and mailing address of the ISA	Authorized officer
European Patent Office, P.B. 5818 Patentlaan 2 NL - 2280 HV Rijswijk Tel. (+31-70) 340-2040, Tx. 31 651 epo nl, Fax (+31-70) 340-3016	Pipping, L

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INTERNATIONAL SEARCH REPORT

Information on patent family members

Inta ional Application No
PCT/US 99/10760

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
US 3970503 A	20-07-1976	NONE	
DE 2002445 A	29-07-1971	NONE	
US 3257915 A	28-06-1966	NONE	